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OF AUDITION.

BY
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OF PHILADELPHIA.



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L. B., a girl, sixteen years old, born of English parents in Philadelphia, doing housework at home, was small in stature and features. The family history was good. Menstruation commenced a year ago, and has been normal and regular.

Her general health was good until July, 1884, when she contracted scarlet fever, followed two weeks later by diphtheria; she was confined to bed and to the house for the subsequent six months, on one occasion being considered beyond recovery. The patient states that her throat was the chief point of treatment, various washes, gargles, swabbings, etc., being used. No positive history of cauterization of the throat could be obtained. In one instance so much force was employed in making a throat-examination, with the handle of a spoon, that four loose (deciduous) teeth were knocked out, and the

¹ This case was presented at the Throat Clinic of the Jefferson Medical College Hospital, in January, 1892, and was placed under my care by Prof. J. Solis-Cohen, for treatment of the pathologic conditions and supplying the deficiency in the soft palate with an artificial appliance.



left commissure of the mouth was cut or lacerated for a distance of half an inch, leaving an irregular skin-scar.

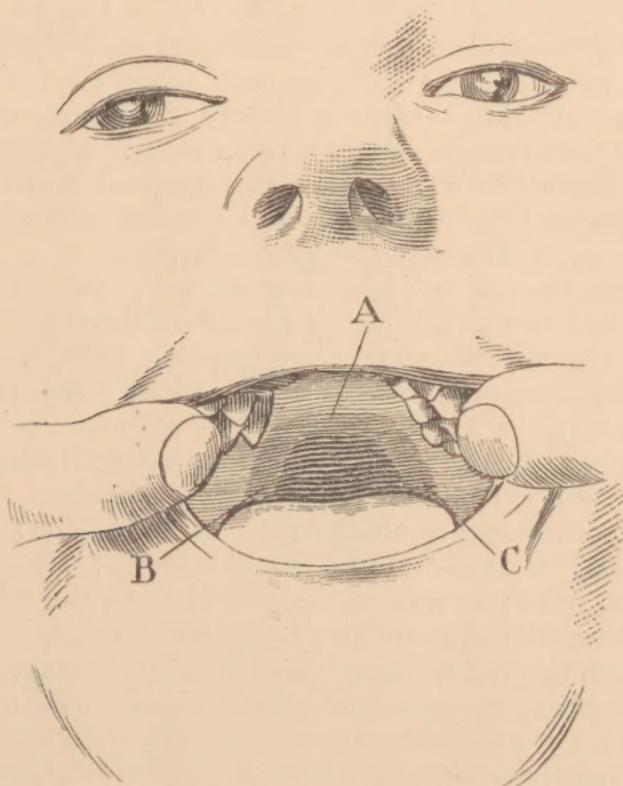
The patient's voice has a most marked nasal twang, and, while speaking, the *alæ nasi* can be plainly seen to open and close the nasal entrance. No history whatever of food or liquids at any time passing into the posterior nares and out through the nose could be obtained.

The patient is hard of hearing; she watches the speaker's lips carefully, and states that ever since the attack of scarlet fever there has been a constant discharge of a very offensive-smelling and light-colored pus from both ears; the discharge is at times quite thick ("creamy"), and at other times watery in consistence. She has occasionally noticed that in the act of coughing, sneezing, or blowing the nose, air passes through and out of the ears. She has not had medical attendance or treatment since convalescence.

Looking into the open mouth (see Fig. 1, half the normal size), all of the permanent teeth are seen to be present, except the two upper cuspids, which are deciduous. The upper teeth are not regular in position. (See edges of the roof-plate, F, in Figs. 2 and 3.) The roof of the mouth is narrow and deep. The tongue appears normal. The fauces show complete absence of the uvula, and in its stead a broad (antero-posterior) cicatricial band, bright-red in color as compared with the surrounding pale tissues, extending across and connecting at the top the lateral pillars on each side. (A, in Fig. 1.) The lateral pillars—the right more particularly—are also broad cicatricial bands, and lie close together, almost as one, at their junction with, and for a short distance below, the uvular band, but may be separated with the end of a probe. (B and C, Fig. 1.) The tonsils are absent. In phonation no movement can be seen to take place in the right anterior pillar; the right posterior pillar acts slightly; the left pillars contract somewhat, as does also the uvular band, especially its left half. Digital ex-

amination proves the right anterior pillar to be a firm, unyielding cicatrix, without any indication whatever of muscular tissue. The left pillars, uvular band, and right posterior pillar, while composed of a great amount of cicatricial tissue, have some muscular fibers remaining.

FIG. I.



Mouth held open with index fingers.

A. Uvular band or cicatrix. B. Right palatine pillars, shown as one. C. Left palatine pillars, shown as one.

The buccal pharynx—that part of the pharynx seen on looking into the widely-opened mouth—is one large, stellate, or spider-shaped cicatrix, having its body

in the center of the buccal pharynx, and its many radiations or branches passing in as many directions. Viewing the post-nasal space with the mirror the left tensor palati muscle is seen to stand out prominently, as compared with its fellow of the opposite side, which consists of cicatricial tissue and has but slight muscular action; as a result, the entrance to the post-nasal space from below is of irregular shape. (K, in Fig. 2.) The various parts, as seen in the post-nasal space—septum, turbinates, entrance to Eustachian tubes, etc.—present no abnormality, except a chronic thickening of the mucous membrane; the otherwise normal condition of the Eustachian tubes having an important bearing on the result of the treatment, as will hereafter be explained. The larynx presented no abnormality.

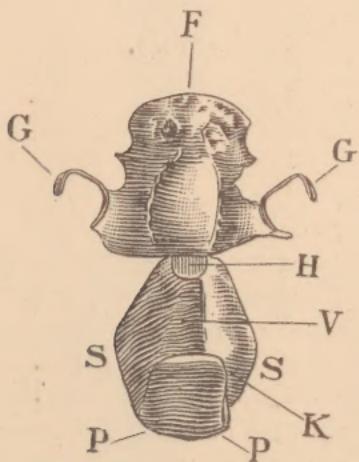
The auditory auricles are normal; the auditory canals, after the removal of the accumulated pus, were found narrow, deep, and macerated, but, owing to sensitiveness or fear on the part of the patient, it was impossible to obtain a satisfactory view of the membranes or ossicles. Air was forced through the ears. Hearing by the watch was: Right, 5 inches; left, 4 inches.

The treatment resolved itself into three parts: First, for the post-nasal and pharyngeal changes; second, for the otorrhea; and, third, the procuring, for the relief of the altered condition of the parts, of an artificial appliance that would improve speech and, possibly, hearing. The parts being so contracted and muscular tissue scarce, the idea of surgical interference was not entertained.

The patient being in apparently good health, there was no indication for constitutional treatment, and none was given. In consultation with a dentist it was considered possible (though not definitely promised) to make a velum that would assist the patient's speech and, perchance, the audition; this possibility being based on the assistance that it was hoped or anticipated could be obtained from the muscular fibers in the right posterior and

left pillars, so as to act on the artificial velum. While this velum was being made, attention was given to the treatment of the throat and ears. For the former, alkaline washes of various strengths were used to keep the parts clean and free from the thick, tenacious mucus that would otherwise accumulate. Under this treatment the secretion diminished in quantity and in tenacity, and with occasional applications of a weak iodine-solution the thickening of the membranes was much reduced.

FIG. 2.



Upper surface of artificial palate.

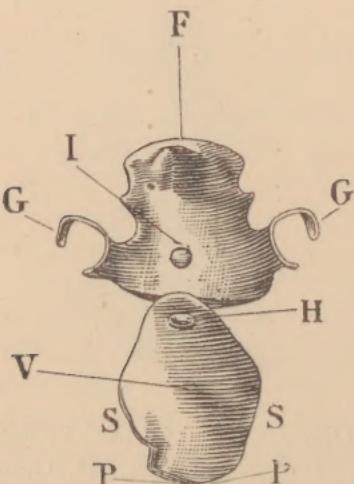
F. Roof-plate. G. Gold bands. H. Upper part of gold stud (*vide* H, in Fig. 3). K. Heel of velum. P, P. Posterior or pharyngeal margin of velum. S, S. Lateral or arch surfaces of velum.

The auditory canals were kept clean by means of a weak solution of hydrogen dioxide, dried with absorbent cotton, and daily insufflations of boric acid. After a few days of this treatment the discharge lost its offensive odor, and at the end of nine weeks there was a cessation of the discharge from the right ear, and in the left at the end of

twelve weeks. Cerumen appeared at about this time, the first noticed since the attack of scarlet fever. A watch could now be heard with the right ear at 7 inches ; with the left at 7 inches. Each ear showed absence of drum-membrane and ossicles. The promontory could be seen, and the foot of the stirrup resting on the oval window.

Figs. 2, 3, and 4 show the upper, under, and right lateral surfaces, respectively, of the artificial palate, one-half the natural size. F, in each figure, is the roof-plate, or the plate that fits to the roof of the mouth ; it is composed of vulcanized rubber, and is exactly the same

FIG. 3.



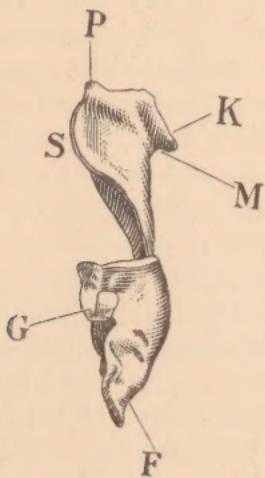
Under surface of artificial palate.

I. Fastening of gold band that passes to form the stud H (Figs. 2 and 3). (Other letters have the same references as in Fig. 2.)

kind of a plate that is used for an upper set of false teeth. G G, in Figs. 2 and 3, are gold clamps that fasten round the first molar teeth, to hold the roof-plate F *in situ*. I, in Fig. 3, is the fastened end of a narrow piece of gold that runs backward through the substance of the roof-

plate to H, Figs. 2 and 3, where it is broadened out into a stud, which holds the velum V, Figs. 2, 3, and 4.

FIG. 4.



M. Anterior aspect of heel. K. Right side view of artificial palate.

(Other letters have the same references as in Figs. 2 and 3.)

The velum is composed of soft red rubber, is very pliable, and takes its original shape as soon as the pressure is removed. K, Figs. 2 and 4, is a (hollow) prominence, or heel, which fits into the naso-pharyngeal space. M, in Fig. 4, shows the anterior part of the heel, which approximates the back of the uvular band, but does not exert any pressure of itself, though just near enough to receive pressure at the time of muscular contraction. The upper margin of the heel, when in position, will be just below the floor of the nares. The irregular shape of the front of the heel will be noticed in Fig. 2.

Placing this unique piece of workmanship *in situ*, it will be understood from the description given that, the velum being in repose, the edges marked S and S

lie accurately against the palatine arches, and that the posterior or pharyngeal margin, P P, Figs. 2, 3, and 4, stands out or hangs away from the pharyngeal wall, leaving a space of less than two-eighths of an inch, which is quite sufficient to allow of free respiration through the nares, and for thin secretions to pass down from above.

When the patient phonates with mouth wide open, the left arch and tensor palati contract at S, Fig. 2, and force the velum up and back ; at the same time the pharynx contracts, comes forward and meets the velum at P P, thus completely closing the nasal passage, and directing the voice forward through the mouth, the artificial velum acting the part or taking the place of the natural velum in opening and closing the nasal passage, as required in talking or swallowing.

As for the velum itself, much is to be said in its favor. The danger of it becoming detached and swallowed is almost *nil*, when it is observed how securely it is held in position by the stud H, Figs. 2 and 3. Owing to the size of the velum, in comparison with the smaller size of the laryngeal opening, it would be impossible for it to take that course, should it become detached. The risk of irritating the parts with which it comes in contact was carefully considered, and for this reason the soft rubber velum was first made ; and as there has been no inflammation or unpleasantness following its use, a hard rubber velum is now in process of construction. One important reason, perchance, that the velum has not irritated the fauces is on account of the insensitive cicatricial condition of the parts.

Secretions accumulate on its upper surface, especially if thick, and, as a consequence, there is a reduction in audition, no doubt from pressure, or plugging of the Eustachian tubes. This is the only inconvenience resulting from the use of the velum, but one that the patient can, and does, easily remedy by removing and cleansing the velum and the parts. There is no diffi-

culty in this; the patient passes the index-fingers to G G, Fig. 2, and, pulling downward on the gold clasps, the plate falls, is lifted from the mouth and cleansed in tepid water; it is easily and securely re-inserted by passing it well back and bringing the gold clasps to the edge of the first molars and pressing upward.

The velum has been made as light and thin as possible, and accurately approximates the buccal pharynx when in action. Were it permissible to allow more space than the present two-eighths of an inch between its posterior edge and the buccal pharynx when in repose there would not be so much, if any, retained secretion, but this cannot be accomplished without leaving an opening into the nasal passage during the action of the velum, and thus neutralize the use for which it is intended. It is hoped that with the use of the velum the mucous membrane may continue to improve and the secretion remain thin enough to flow freely at all times through the space allowed, and by the aid of nasal inspiration the patient be able to draw the mucus into the throat. By reason of the retained secretion the patient is not allowed to wear the velum during sleep.

Two mechanisms being required in speech—the laryngeal and oral (the vibrator and resonator)—and normal speech requiring perfect coördination of the two, the velum in this case, by supplying the previous vacancy, gives almost perfect resonance as the result, and does away with most of the former nasal twang. This twang will further diminish and gradually pass away as the patient overcomes her habit of closing the nostrils with the alæ nasi. Prior to the use of the velum, in pronouncing words containing a *c* or *s* followed by a vowel, there was a marked *th*-sound, but this is rapidly leaving, and is now almost gone. Six was pronounced "thix"; seven, "theven"; sound, "thound"; Susie, "Thuthie"; cider, "thider"; Cincinnati, "Thinthinati," etc.

The improvement in hearing that has resulted from the use of the velum is an advantage that equals, if it does not exceed, the bettered speech. As the title of this article states, the improvement in audition was immediate (R. and L. = 20 inches), and has increased gradually until at the time of writing, six weeks from the first use of the velum, the hearing for the watch has reached, right and left, 31 inches. As soon as the velum is removed, the audition for the watch falls to, right and left, 7 inches, showing that the improvement is most likely mechanical—*i. e.*, from the support given to the Eustachian tubes. Had the entrances to the tubes suffered from ulceration; as did the other tissues, it is not likely that the velum would have improved audition.

With this improved audition and speech the patient becomes a better and happier member of society, and now enjoys her surroundings and associates with greater satisfaction than at any time since her recovery from the scarlet fever. Prof. Cohen, who has just examined the case, pronounces it the most successful result he has ever witnessed in such extensive devastation of tissue.

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